DOCUMENT RESUME

ED 060 021 TM 001 103

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TITLE An Objective Method of Measuring Psychological States Associated With Changes in Neural Function: Content Analysis of Verbal Behavior.
PUB DATE Mar 70
NOTE 25p.; Paper presented at the Annual Meeting of the American Neurosurgical Society, Ojai, California, March 1970

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Anxiety; Cognitive Measurement; *Content Analysis; Drug Therapy; Emotional Response; Hostility; Intellectual Development; *Measurement Techniques; Neurology; *Physical Characteristics; *Psychological Evaluation; Psychological Testing; Sex Differences; Speech Evaluation; Tape Recordings; *Verbal Communication

ABSTRACT

This paper examines the use of content analysis of speech in the objective recording and measurement of changes in emotional and cognitive function of humans in whom natural or experimental changes in neural status have occurred. A brief description of the data gathering process, details of numerous physiological effects, an anxiety scale, and a verbal sample coded for anxiety are included. (DLG)

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AN OBJECTIVE METHOD OF MEASURING PSYCHOLOGICAL STATES ASSOCIATED WITH CHANGES IN NEURAL FUNCTION: Content Analysis of Verbal Behavior*

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A not infrequent problem encountered by neural scientists is the objective recording and measurement of changes in emotional and cognitive function of human subjects in whom natural or experimental changes in neural status have occurred. An objective method has been developed--involving the content analysis of verbal behavior--which is especially applicable to this problem. The method allows collection of the raw data--namely, tape-recorded speech--by the neural scientist, himself, or by a research technician, if preferable.

THE CONTENT ANALYSIS METHOD OF MEASURING PSYCHOLOGICAL STATES

The measurement method that I have developed with my associates utilizes a function that is uniquely human, namely speech and its content or semantic aspects. The development of this method has involved a long series of steps. It has required that the psychological dimensions to be measured (for example, anxiety, hostility outward, hostility inward, cognitive or intellectual impairment, achievement strivings, social alienation-personal disorganization and so forth) be carefully defined; that the content, the lexical cues, be spelled out from which a receiver of any verbal message infers the occurrence of the psychological states; that the linguistic, principally syntactical, cues conveying intensity be specified; that differential weight be assigned for

*Presented at the Annual Meeting of the American Neurosurgical Society, Ojai, California, March 26, 1970.

In press J Biol Psychiatry 4:33-49 (1972)

semantic and linguistic cues whenever appropriate; and that a systematic means be arrived at of correcting for the number of words spoken per unit time so that one individual can be compared to others or to himself on different occasions with respect to the magnitude of a particular psychological state. The method requires, also, that a formal scale of weighted content categories be specified for each psychological dimension to be measured; that research technicians be trained to apply these typescripts of human speech (much as biochemical technicians are trained to run various chemical determinations by following prescribed procedures); that the interscorer reliability of two trained content technicians using the same scale be .85 or above (a modest but respectable level of consensus in the behavioral sciences for these kinds of measurements). Moreover, a set of construct validation studies have had to be carried out to ascertain exactly what this content analysis procedure was measuring, and these validation studies have included the use of four kinds of criterion measures: psychological, physiological, pharmacological, and biochemical. On the basis of these construct validation studies, changes have been made in the content categories and the associated weights of each specific scale, on the many validation studies we have done, in the direction of maximizing the correlations between the content analysis scores with these various criterion measures.

Construct validation of any behavioral or psychological test instrument requires repeated re-examination and re-testing, in new situations, of the variables being evaluated. After initial validation studies were completed for verbal behavior measures of such psychological states as anxiety, hostility outward or hostility inward, social alienation-personal disorganization (an objective dimension constituting the main features of schizophrenia), cognitive and intellectual impairment, achievement strivings, a large variety of additional investigations have been carried out using these verbal behavior measures.

These further investigations have provided considerable data on the ways in which such verbal behavior scores relate to other relevant measurable phenomena. These data have afforded solid evidence as to how the psychological states measured by our verbal behavior mesaures "fit" with other empirical data (Gottschalk et al, 1958a, 1960, 1961a, 1963, 1964; Gleser et al, 1961).

A brief comment on the theoretical framework from which our measurement approach has developed. Our theoretical approach has been truly eclectic in that we have borrowed heavily from behavior and conditioning theory, psychoanalytic clinical hypotheses, and linguistic theory. The theoretical aspects of our method have been built into our verbal behavior scales, so that the scoring or content analysis technician applying our procedure to typescripts of tape-recorded speech need not worry about approaching the job with one theoretical approach or another; rather, he carefully follows a strictly empirical approach, scoring the occurrence of any content or themes in each grammatical clause of the speech according to a "cookbook", namely, our verbal behavior scales, which indicate what semantic categories should be looked for and how much the occurrence of each one is to be weighted. The technician then follows prescribed mathematical calculations leading up to a final score for the magnitude of any one psychological state or another.

The formulation of these psychological states has been deeply influenced by the position that they all have biological roots. Both the definition of each separate psychological state and the selection of the specific verbal content items used as cues for inferring each states were influenced by the decision that whatever psychological state was measured by this content analysis approach should--whenever possible--be associated with some biological characteristic of the individual in addition to some psychological aspect or some social situation.

The details of the reliability and validity studies and the specific

investigations pinning down each point have been published over the past thirteen years. They have recently been collected in two books, written with my principal collaborator in this area, and these books describe many newer unpublished investigations on the subject (Gottschalk and Gleser, 1969; Gottschalk, Winget, and Gleser, 1969).

These content analysis scales can be applied to different kinds of language material obtained in a variety of situations and in both spoken and written form. Most of our reliability and validity studies have been done on small samples of speech, three to five minutes in duration, obtained in a response to standard instructions. The instructions to elicit speech from a subject have been purposely relatively ambiguous and nonstructured, except that a report of personal or dramatic life experiences has been requested. We were led to use such instructions because of our initial aim to probe the immediate emotional reactions of our interviewees, instead of the typical or habitual ones, and to minimize reactions of guarding or covering up. We settled on using standardized instructions, also, in order to compare individuals in a standard context so that demographic and personality variables could be explored and investigated, while holding relatively constant the influence of such variables as the instructions for eliciting the speech, the interviewer, the context, and the situation. The effects of varying these non-interviewee variables have subsequently been investigated, one by one, after reliable and valid content analysis scales were developed.

The standard instructions we have used to elicit many five minute verbal samples are typically typed on a three-by-five card and are read aloud to the subject prior to turning on the tape-recorder. They read: "This is a study of speaking and conversation habits. Upon a signal from me I would like you to speak for five minutes about any interesting or dramatic personal life experiences you have had. Once you have started I will be here listening to

you, but I would prefer not to reply to any questions you would feel like asking me until the five minute period is over. Do you have any questions you would like to ask me now before we start? Well, then you may begin."

These instructions are designed to simulate roughly a projective test situation. The lack of verbal responsiveness of the examiner during the period the subject is speaking, plus a conscious attempt on the part of the examiner to keep at a minimum any non-verbal cues that might indicate his reactions to the subject, tend to give the examiner in the total situation the quality of "blank screen" on which the subject projects some part of the gamut of his reactions to any vaguely similar life situation within his past experience. We find that what the subject talks about during any one verbal sample depends in large part of what psychological conflicts and feelings are being most probably experienced at that time, that is, what feelings and conflicts are most highly aroused and focal at the moment. This psychological state determines how the subject perceives the experimental situation and of what events from his remote or recent past he is reminded. The standardized nature of the situation in which the verbal samples are elicited minimizes the interviewer as a variable influencing the interviewee's subjective state and speech and leaves the interviewee's reactions (appropriate and inappropriate) as a predominate variable in the interpersonal interaction.

These content analysis procedures can be, and have been applied to interview material, psychotherapeutic, diagnostic or otherwise. The typed data can be broken down into equal temporal units (for example, two of five minute segments). Or the units can be based on the number of words spoken by one or both participants (or more if they are present); for example, consecutive 500 word sequences of the speaker's can be coded for content. Depending on the purpose and research design of the study period, these content analysis scales have also been applied to dreams, projective test data (specifically, tape-

recordings of Thematic Apperception Test responses), to written verbal samples, and even to literature, letters, public speeches, and any other type of language material.

An example follows of the simplest content analysis scale we have developed, the Anxiety Scale, followed by an example of a coded and scored speech sample. The example illustrates the system of scoring those clauses which have scorable anxiety items, with appropriate symbols designating each category in the anxiety scale. (Schedule I and Example I go about here.) The numbers in parentheses in the verbal sample indicate the weights assigned to each scorable content item. The diagonal marks indicate grammatical clauses. A detailed description and discussion of scoring procedures, with many examples is provided in A Manual for Using the Gottschalk-Gleser Content Analysis Scales (Gottschalk, Winget, and Gleser, 1969).

Illustrations of Neuroscience Applications of Our Content Analysis Verbal Behavior Scales

I. Some Demographic Factors Influencing Emotions

1. Anxiety and Intelligence

An analysis of variance of the verbal anxiety scores for 90 individuals employed at the same company (Kroger) reveal a significant negative trend in an anxiety with I.Q. level ($p < .05$), the lowest I.Q. group having the highest anxiety scores ($r = -.28$). The difference is probably not due to I.Q. and/or education, but since the task involves extemporaneous speaking into a microphone, an activity for which individuals with the lower I.Q. sometimes feel inadequate, higher shame anxiety is elicited in people with lower I.Q. (See Figure 1).

(Figure 1 goes about here.)

2. Anxiety and Sex Differences

No sex differences have been found in large samples of individuals for overall anxiety scores, but in six separate subscale scores for anxiety, we have found in normative samples (173 males and 109 females), higher scores for females on separation and shame anxiety as compared to males; whereas males have significantly higher scores on death and mutilation anxiety. (See Figure 2)

(Figure 2 goes about here.)

3. Anxiety and Age

The relationship between age and anxiety has been examined in several samples of adults and no evidence of a linear relationship has been found. One subscale of anxiety, however, evidently increases consistently with age. In three separate samples of people we have found correlations of .25, .24, and .28 between age and death anxiety. Such a relationship makes sense, since death appears increasingly important and threatening as one grows older.

4. Hostility Scores and Race

In several series of studies, lower hostility-out scores were found in Negroes as compared to Caucasians. The difference between the hostility outward scores in black and white people is more marked among females. This finding has been thought to be due either to the suppression of hostility in Negroes or to the fact that most of these verbal samples were collected by white interviewers.

5. Hostility Outward Scores and Sex

There has been found a significant trend for higher hostility outward scores to be present in the five minute verbal sampels of males as compared to females.

II. Psychophysiological Findings

1. Anxiety and Skin Temperature

A group of twelve high school boys 16-17 years of age gave four verbal samples on each of two separate occasions while continuous measurements of skin temperature were being taken (Gottlieb et al, 1967). The first five minute verbal sample was taken prior to hypnotizing the subject, whereas subsequently three verbal samples were obtained while the subject was in a hypnotic state. The anxiety scores from the six verbal samples obtained under hypnosis were correlated with the decrease in skin temperature occurring during the giving of the verbal sample for each student separately, using a rank-order correlation. Ten of the twelve correlations were positive ($p < .04$), yielding an averaging intrasubject correlation of .31.

In another study, examining the correlations between five minute sequences of two psychotherapeutic interviews and skin temperature (Gottschalk et al, 1961b), significant negative correlation was found between the anxiety scored in each five minute interval and the change in skin temperature from the beginning to the end of each five minute interval (Gottschalk and Gleser, 1969, p. 278f.).

2. Anxiety Scores From Dream and Inhibition of Penile Erection With Rapid Eye Movement (REM) Sleep.

Karacan et al, (1966) studied the relationships of penile erections during episodes of rapid eye movement sleep and the anxiety scores derived from the tape-recorded dreams reported upon awakening from such periods of sleep. A statistically significant association was found between anxiety scores from such dreams and the lack of penile erections.

3. Studies of Relationships of Emotions to Plasma Lipids

A natural history study (Gottschalk et al, 1965, 1968) disclosed different relationships between several types of emotions and blood lipids in a group

of 24 men who had fasted ten to twelve hours. Findings were cross-validated in a study of a second group of 20 men. Anxiety scores have a significant positive correlation with plasma free fatty acids (FFA) in both groups--a sign of catecholamine (adrenergic) secretion. Whereas, three types of hostility had essentially zero correlation with free fatty acids. More anxious men tended to have higher free fatty acid levels and sharper rises in FAA than nonanxious men in a reaction to a venipuncture and free associating for five minutes. There was evidence for positive correlations between plasma triglyceride levels and both anxiety and hostility inward scores as well as for total hostility outward scores and levels of blood cholesterol. We have found that nonathlete, college students tend, as a group, to have higher plasma free fatty acid responses to the same anxiety levels than college students, who are athletes (either on the football or swimming teams). (See Figure 3 and Table 1).

(Figure 3 and Table 1 go about here)

4. Anxiety Levels and Dreams: Relation to Changes in Plasma Free Fatty Acids

Blood samples for determination of plasma free fatty acids were obtained throughout the night by means of an indwelling venous cathether. The first blood sample was drawn at the onset of rapid eye movements and the second after 15 minutes of these eye movements. Subjects were then wakened and asked to relate their dreams; a third sample was drawn 15 to 25 minutes later. Anxiety scores derived from twenty dreams of nine subjects have significant positive correlations with changes in free fatty acids occurring during REM sleep. There were no positive correlations with hostility scores derived from the same dreams. These findings indicate that anxiety aroused in dreams triggers the release of catecholamines into the circulation and these catecholamines mobilize proportional amounts of plasma free fatty acid from body fat (Gottschalk et al, 1966b).

5. Corticosteroid Levels and Hostility and Anxiety

Five minute verbal samples, elicited by our standardized method, were analyzed for hostility and anxiety scores and correlated with corticosteroid levels of 28 nonpsychotic male medical patients (Gottschalk and Gleser, 1969). A correlation of plus 40 was obtained between hostility outward levels and the average plasma 17-hydroxycorticosteroid levels; the correlation was higher with the corticosteroid level obtained one hour after the five minute sample was obtained (+.47) than that obtained one hour before this time (+31). No correlation was found between plasma 17-hydroxycorticosteroids and anxiety and hostility inward scores. In our own studies, the psychochemical relationships have been observed at relatively low levels of arousal fo these emotions, that is, in situations where there was no contrived stress and in which the data was collected in a natural history setting. These facts may account for why both anxiety and hostility did not arouse corticosteroid secretion in our studies.

6. Anxiety and Hostility Levels and Phases of the Menstrual Cycle

Five minute verbal samples given daily by small numbers of women for periods up to three months have indicated that different women have different cycles of anxiety and hostility, depending upon their own personal reactions to the changing hormonal levels of their cycles. Across individuals, however, women as a group show a transient decrease of anxiety and hostility at the time of ovulation, presumably related to the secretion of luteinizing hormone. Also, they show an increase in anxiety premenstrually (Gottschalk et al, 1965; Ivey and Bardwick, 1968). Recent studies (Silbergeld et al, 1969--unpublished) have shown that Enovid reduces the hostility outward scores of women. This finding would appear to corroborate our own studies referred to above and other (Garrattini et al, 1968) to the effect that the male sex hormones are related to manifestation of more hostile aggression and the female sex hormones

are related to less destructive aggression in humans and sub-human animals.

III. Anxiety and Hostility in Response to Psychoactive Drugs

We have done many studies using our content analysis procedure in neuropsychopharmacological investigations. In almost all of our studies we have used the double-blind, cross-over design. These studies have been of considerable interest to us because they afford a means of influencing the neurochemical environment of the brain and observing the behavioral and psychological effect as measured through speech. The minor tranquilizer, chlordiazepoxide, in 46 juvenile deliquent boys administered 20 mg. of the drug, produced significant decreases in anxiety, ambivalent hostility, and overt hostility outward 40 to 120 minutes after ingesting the chlordiazepoxide (Gleser et al, 1965). In another study (Gottschalk et al, 1960) 20 dermatologic inpatients (10 men and 10 women) were given perphenazine, 16 to 24 mg. a day by mouth for one week alternating with a placebo for one week, using a double-blind, cross-over design. Analysis of the content of five minute verbal samples obtained from these patients showed a reduction of hostility outward scores with perphenazine and 16 of the 20 patients ($p < .01$) and a decrease in anxiety scores at the elevated end of the spectrum of the anxiety scores. Another study showed an increase in anxiety and overt hostility-out scores derived from verbal samples in patients receiving the anti-depressant drug, imipramine, as compared to a placebo (Gottschalk et al, 1965).

Studies of the content analysis of the speech of individuals administered psychotomimetic drugs (LSD 25, Ditran, or Psilocybin) or a placebo showed that people receiving psychotomimetic drugs have significantly higher content analysis scores on our cognitive and intellectual impairment scale than when they receive a placebo (Gottschalk and Gleser, 1969).

The implications of these findings is that the neurochemical changes produced by these pharmacological agents are a functional decrease in utilizable catecholamines in the brain with tranquilizers, such as chlordiazepoxide and perphenazine, and an increase in such catecholamines with the administration of the anti-depressant psychoactive drugs such as imipramine (Schildkraut et al, 1968).

IV. The Relationship of the Magnitude of Emotions, as Determined from Content Analysis During an Interview, and Paroxysmal Electroencephalographic Activity

A 20 year old single white male, Army private, an inpatient at Walter Reed Army Hospital in Washington, D.C. for the study of the etiology of grand mal seizures he developed during military duty without a history of head injury, was found to have high amplitude bursts of slow wave paroxysmal activity on his electroencephalograph (Gottschalk, 1955). Several hourly sessions of EEG recordings were carried out while he was interviewed. The content of the interview was synchronized with his EEG recordings so that the content of what he was saying could be related to his paroxysmal EEG activity. Seventeen thirty-word segments of his speech occurring just before a paroxysmal EEG event were selected from these interviews as well as 17 thirty-word segments which were not immediately followed by abnormal EEG activity. My content analysis technicians were asked to score these thirty-word segments for total affects (anxiety and hostility scores combined) and for total affects, including positive as well as negative emotions (scores derived from our Human Relations Scales--a measure of the capacity for congenial human relationships--plus the total affect scores).

Paroxysmal EEG activity was found to be preceded significantly more often by a higher total affect score ($p < .05$), regardless of the combinations of content analysis scores used. (See Figure 4) Anxiety ($p < .05$) and hostility inward ($p < .05$) scores were found to account principally for this finding;

whereas, hostility outward and ambivalent hostility scores showed were not significantly related to abnormal paroxysmal EEG activity.

V. Cognitive and Intellectual Impairment Measured From Five-Minute Samples of Speech

Preliminary development has been carried out on a content analysis scale derivable from five minute samples of speech, which measures the magnitude of cognitive and intellectual impairment. The purpose of this scale is to assess the magnitude of transient and reversible changes in general cognitive and intellectual function as well as irreversible changes, all due principally to brain dysfunction and minimally to transient and emotional changes in the individual (Gottshchalk and Gleser, 1969, p. 228f). At its present state of development, this content analysis scale of cognitive and intellectual impairment is capable of differentiating patients with organic brain syndromes from nonbrain damage patients and individuals (See Table 8.2). Correlational studies with two measures of irreversible brain damage, the Halstead battery (1947) and the Trail Making Test (1958) on a group of 20 subjects, male and female, ranging in age from 40 to 84 shows satisfactory correlations with both of these measures (Halstead battery, r=.55, and Trail Making Test, r=.48). The use of this cognitive and intellectual impairment scale to study the effects of psychotomimetic agents indicate that LSD-25 promotes cognitive impairment, rather than the schizophrenic syndrome, and that it induces a toxic mental disorder rather than a functional one.

Another study, recently published (Gottschalk et al, 1969) using the cognitive and intellectual impairment scale explored the effect of total or half body irradiation on intellectual functioning. This study provided suggestive evidence of temporary impairment of such functioning immediately after exposure to such radiation. We believe that this scale, at its present stage of development, measures general intellectual functioning rather than the

functioning of any specific part of the brain. The possible usefulness of this scale, as well as some of our other scales, during stimulation or functional impairment of various parts of the brain, during neurosurgical procedures, are obvious.

VI. Achievement Striving Scores, Derived From the Content Analysis of Five Minute Verbal Samples, as They Relate to Induced Mental Set or Psychomotor Stimulants

One study (Gottschalk et al, 1967) on college students has shown that telling these students that a pill would make them "more peppy and energetic" (whether the pill was a placebo, 90 mg. of secobarbital, or 10 mg. of dextroamphetamine) significantly increased the achievement striving scores of these students, regardless of the medication they were administered. On the other hand, dextroamphetamine (10mg.) by mouth also significantly increased achievement striving scores, regardless of the set induced. This study demonstrated that induced mental set and drug effect can be additive.

In another study (Waskow et al--unpublished) achievement striving scores were found to be significantly higher ($p < .01$) in the five minute samples of a large group of male prisoners (N=33) at the Patuxent, Maryland penitentiary as compared to the effectiveness of the placebo alone.

DISCUSSION AND SUMMARY

This review of previous studies using this objective method of assessing the magnitude of various psychological states, will certainly give many of you an idea of its potential usefulness in many kinds of research in the neural sciences. In our own research, we have been eager to collaborate with neurosurgeons who might be involved in stimulating or interferring with the function of various parts of the central nervous system. Also, the range of psychological and behavioral reactions to stimulation of electrodes implanted

in the central nervous system in humans could most likely be measured by our content analysis procudure. I would be interested in collaborating with any neurosurgeons who might find our procedure of possible interest and usefulness in their own clinical and research studies. Continuing studies of our own are revealing that the intravenous administration of barbiturates, benzodiazepine derivative (e.g. chlordiazepoxide or diazepam), or placebo indicate that my procedure is a very sensitive and accurate method of detecting potentially new anti-anxiety pharmacological agents. We are pursuing further neurochemical studies to explore relationships with some of our verbal behavior variables and endocrines such as testosterone, estrogens, insulin, growth hormone, corticosteroids, ACTH, et cetera.

If we could computerize the content analysis of speech, which will probably take about a decade, we anticipate that many new break-throughs in the neural sciences will be possible.

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SCHEDULE 1

Anxiety Scale

1. Death anxiety--references to death, dying, threat of death, or anxiety about death experienced by or occurring to:

   a. self (3).
   b. animate others (2).
   c. inanimate objects (1).
   d. denial of death anxiety (1).

2. Mutilation (castration) anxiety--references to injury, tissue or physical damage, or anxiety about injury or threat of such experienced by or occurring to:

   a. self (3).
   b. animate others (2).
   c. inanimate objects destroyed (1).
   d. denial (1).

3. Separation anxiety--references to desertion, abandonment, ostracism, loss of support, falling, loss of love or love object, or threat of such experienced by or occurring to:

   a. self (3).
   b. animate others (2).
   c. inanimate objects (1).
   d. denial (1).

4. Guilt anxiety--references to adverse criticism, abuse, condemnation, moral disapproval, guilt, or threat of such experienced by:

   a. self (3).
   b. animate others (2).
   d. denial (1).

5. Shame anxiety--references to ridicule, inadequacy, shame, embarrassment, humiliation, overexposure of deficiencies or private details, or threat of such experienced by:

   a. self (3).
   b. animate others (2).
   d. denial (1).

6. Diffuse or nonspecific anxiety--references by word or phrase to anxiety and/or fear without distinguishing type or source of anxiety:

   a. self (3).
   b. animate others (2).
   d. denial (1).

EXAMPLE 1

Verbal Sample # 1 Coded for Anxiety

Name of Subject:
(Male psychiatric inpatient)
Date:
Name of Study:

Interviewer:
Total Words: 187
Correction Factor: 0.5348

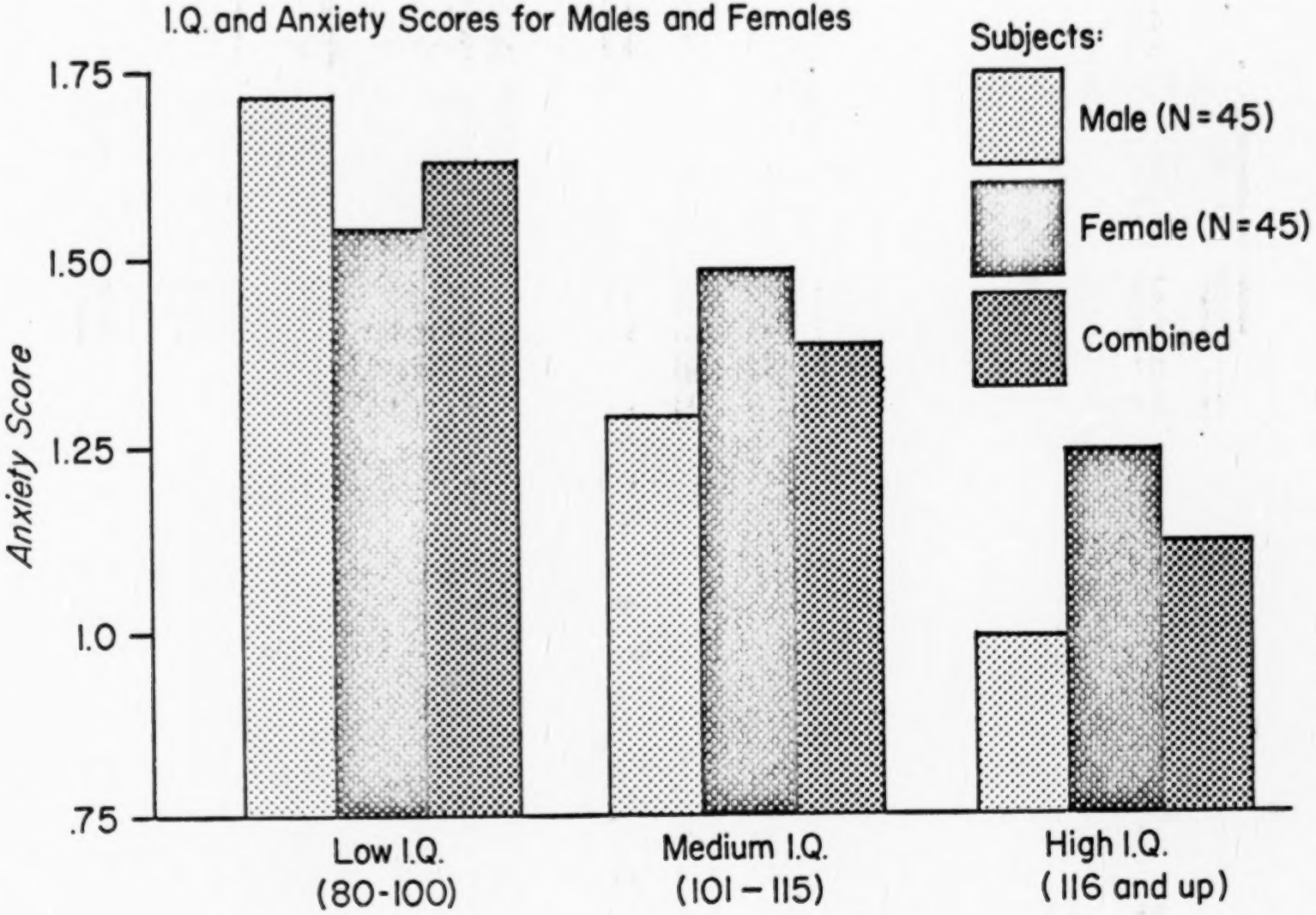
5a3
What do you want me to say? / I don't know what to talk about. /
5a3
Well, let's see . . . / I don't know what to talk about, Doc. / Uh I've been here for about four months / and uh had a pretty rough time of it. / And and uh my wife, she wants me to stay here / as long as
6a3
I can. / I I told her / I would. / Our babies, they get on my nerves, my little babies. / Sometimes I don't get no sleep. / (Pause) Got a
2b2 2b2
little cat at home. / It got hurt, / it got a broken leg / and I had to get that fixed. / (Pause) I had a pretty rough time of it. / My dad,
1b2 3a3
I lost my dad in '51, / now only got two brothers living. / And they
3a3 4a3
never come to see me. / I guess / it's pretty much my fault. / And uh my wife she she changes her mind all the time. / I think / she's
6b2 4b2
kind of nervous too. / She thinks / she hears people saying bad things
6a4
about her. / I get sort of frightened and scared about it all. / I don't know / what else I can tell you. / That's all / I can think of. /

TABULATION OF VERBAL SAMPLE # 1 CODED FOR ANXIETY
Correction Factor (C.F.) = 0.5348

Subcategory	Total weight (W.)	Raw score (W. × C.F.)
Death		
1b2 × 1	2	1.07
Mutilation		
2b2 × 2	4	2.14
Separation		
3a3 × 2	6	3.21
Guilt		
4a3 × 1		
4b2 × 1	5	2.67
Shame		
5a3 × 2	6	3.21
Diffuse		
6a4 × 1		
6a3 × 1	9	4.81
6b2 × 1		
Total	32	17.11

17.11 + ½ C.F. = 17.38
Square root = 4.17

FIGURE 1


I.Q. and Anxiety Scores for Males and Females
Anxiety Score
1.75
1.50
1.25
1.0
.75
Low I.Q.
(80-100)
Medium I.Q.
(101 – 115)
High I.Q.
(116 and up)
Subjects:
Male (N=45)
Female (N=45)
Combined

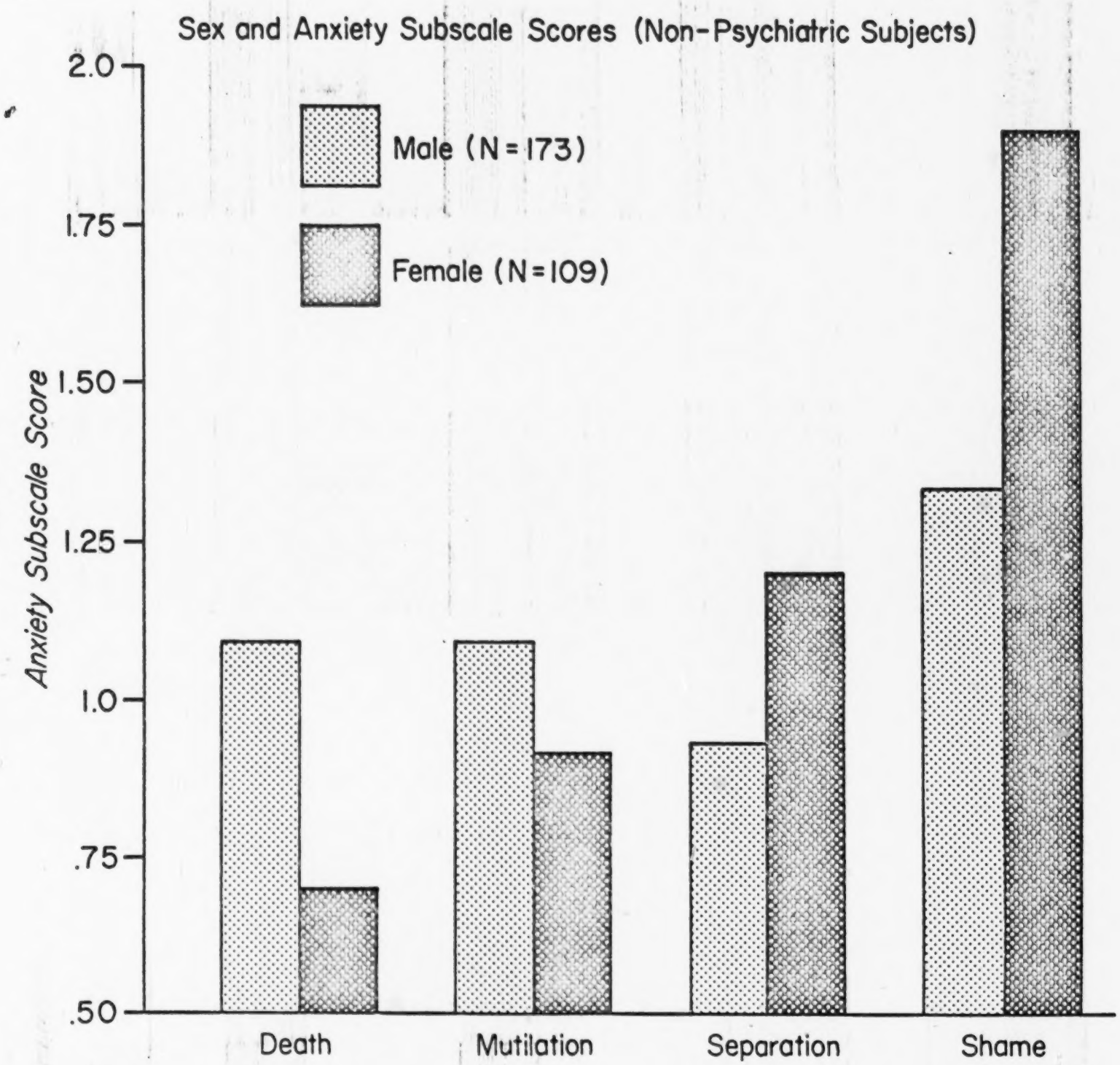

Sex and Anxiety Subscale Scores (Non-Psychiatric Subjects)
Male (N = 173)
Female (N = 109)
Anxiety Subscale Score
2.0
1.75
1.50
1.25
1.0
.75
.50
Death
Mutilation
Separation
Shame

FIGURE 2

FIGURE 3

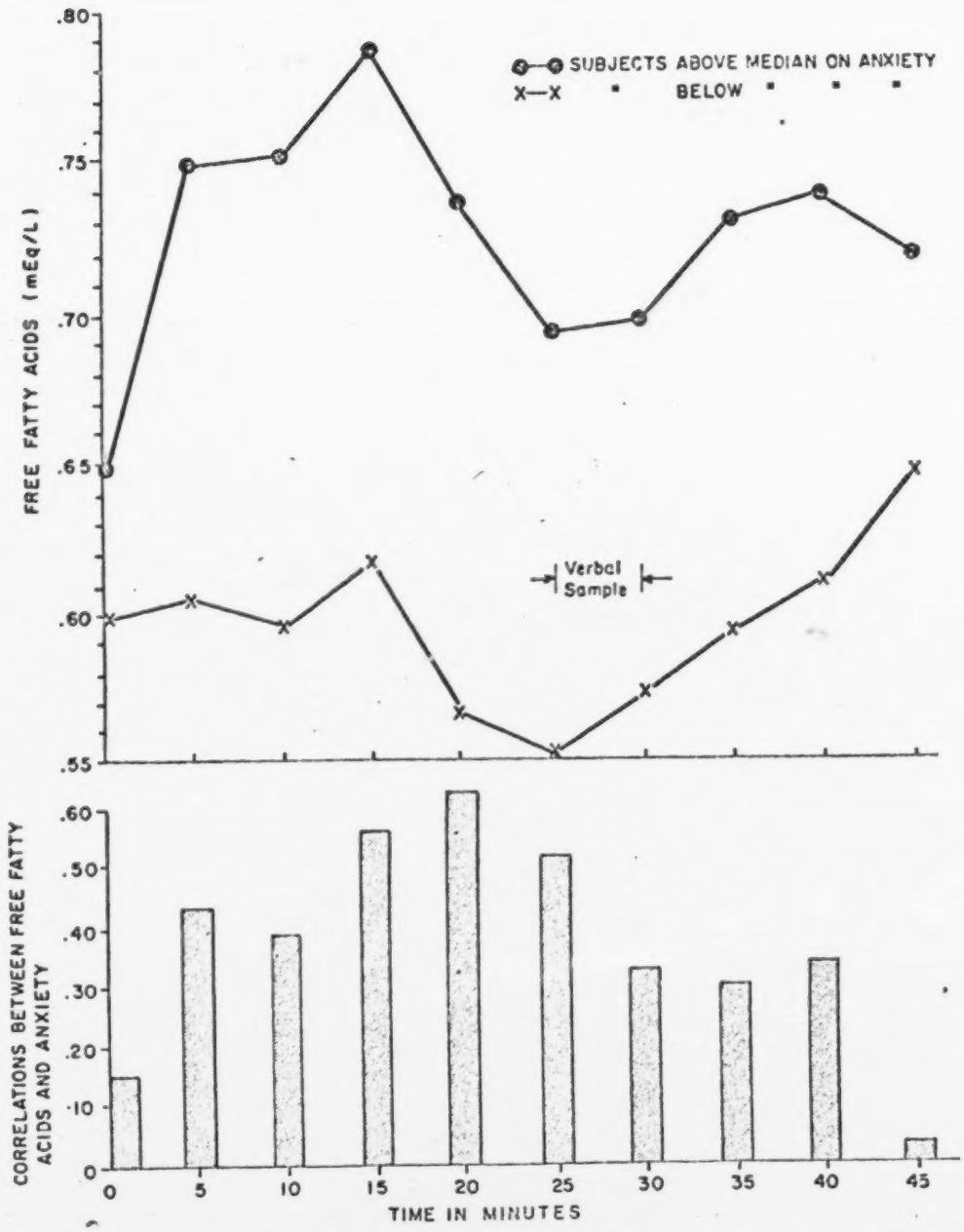


Fig. 3. Group 2. Variations in free fatty acids over time in anxious and nonanxious subjects.

FIGURE 4

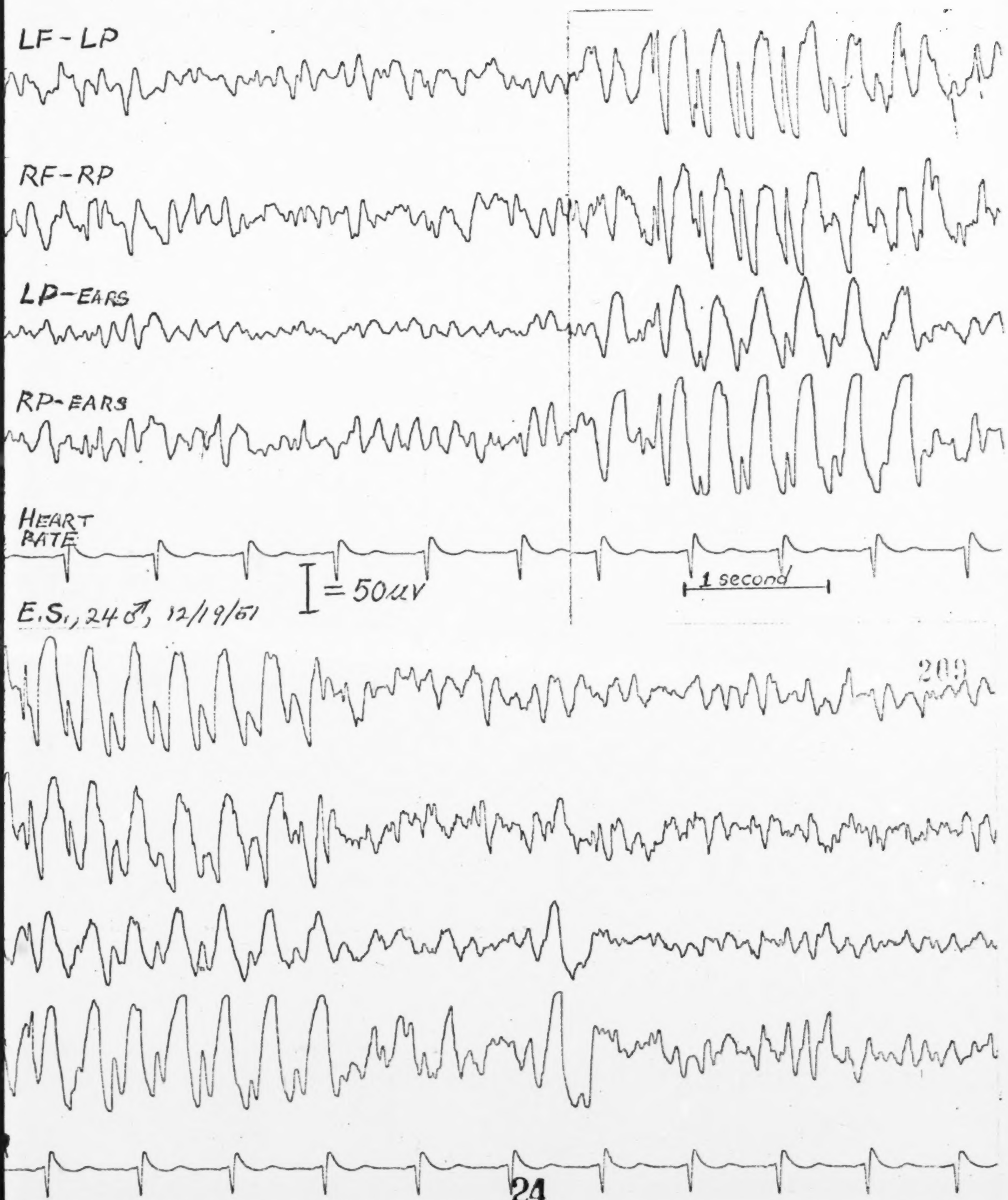

LF - LP
RF - RP
LP - EARS
RP - EARS
HEART RATE
= 50μv
1 second
E.S., 24 ♂, 12/19/51
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TABLE 1.

Group 2. Correlations among Lipids and Verbal Affect Measures

Measure	Mean	s.d.	Serum lipids: Triglycerides	Serum lipids: Av. free fatty acids	Immediate affect scores: Anxiety	Hostility: Outward: Overt	Hostility: Outward: Covert	Hostility: Outward: Total	Hostility: Inward	Hostility: Ambivalent
Cholesterol, mg. %*	185.10	29.36	.30	—.13	—.24	.51	.08	.37	—.28	—.03
Triglycerides, mg. %	59.35	35.64	.....	.17	.26	—.03	—.11	—.18	.47	.07
Av. free fatty acids, mEq/L	.66	.13	.....	.....	.44	—.08	—.07	.00	.36	.04
Anxiety	1.29	.53	.....	.....	.....	.14	.00	.08	.52	.42
Hostility outward	.64	.28	.....	.....	.....	.....	.32	.87	—.03	.47
Overt	.56	.26	.....	.....	.....	.....	.....	.72	.02	.02
Covert	.81	.35	.....	.....	.....	.....	.....	.....	—.08	.33
Total	.60	.22	.....	.....	.....	.....	.....	.....	.....	.04
Hostility inward	.66	.33	.....	.....	.....	.....	.....	.....	.....	.....
Ambivalent hostility										

* Age was not partialed out for this group, since the age range was extremely limited.